COVER STRUCTURE FOR HEAT EXCHANGER HAVING RESINOUS TANK

CROSS REFERENCE TO RELATED APPLICATION

This application is based on Japanese Patent Application No. 2002-230353 filed on August 7, 2002, the disclosure of which is incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to a cover structure that restricts adhesion of foreign materials to a resinous tank of a heat exchanger such as a vehicular radiator.

BACKGROUND OF THE INVENTION

With regard to a resinous tank of a radiator, the tank is for example made of nylon 66 (polyamide 66). As shown in Fig. 7, when a radiator 400 having such resinous tank 410 is used in cold regions where an antifreezing agent is spread, if the antifreezing agent is thrown up, it is likely to pass through a grill 40 and directly adhere to the tank 410 as denoted by a thick arrow B. As a result, it causes environmental stress cracks on the tank 410.

In order to restrict the environmental stress crack of the resinous tank, for example, it is proposed to blend nylon 12 (polyamide 12) and nylon 612 (polyamide 612), which have resistant to the antifreezing agent, with the nylon 66. However, such resistant materials are generally more expensive than the nylon 66. Thus, it results in an increase in cost of

the radiator. Alternatively, it is proposed to employ a cover 420 for restricting the antifreezing agent from adhering to the tank 410, as shown in Fig. 8. It also causes an increase in cost.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a cover structure capable of reducing deterioration of a resinous tank of a heat exchanger due to adhesion of foreign materials such as an antifreezing agent.

According to the present invention, a cover structure is applied to a heat exchanger that has a resinous tank and a core portion for performing heat exchange. The heat exchanger is arranged adjacent to an opening through which air is introduced. A cover member includes a wall having a first end and a second end opposite to each other. The cover member is disposed such that the first end is adjacent to a boundary between the core portion and the tank and the second end is adjacent to the opening so that air passing through the opening is directed toward the core portion.

Accordingly, the wall blocks and restricts the foreign materials from adhering to the tank. Therefore, the tank is less likely to deteriorate due to the foreign materials. Further, since the air is introduced toward the core portion along the wall, efficiency of heat exchange improves. Thus, it is possible to reduce the size of the heat exchanger.

Preferably, the cover structure is employed in a front

end of a vehicle. Especially in cold regions where the antifreezing agent is spread on roads, the cover member restricts the antifreezing agent from adhering to the tank. Thus, it reduces environmental stress cracks on the resinous tank.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the present invention will become more apparent from the following detailed description made with reference to the accompanying drawings, in which like parts are designated by like reference numbers and in which:

Fig. 1 is a cross-sectional view of a cover for explaining an arrangement of the cover on a vehicle according to the first embodiment of the present invention;

Fig. 2 is a perspective view of the cover according to the first embodiment of the present invention;

Fig. 3 is a cross-sectional view of the cover and a frame according to a modification of the first embodiment;

Fig. 4 is a cross-sectional view of a cover and a tank of a heat exchanger according to the second embodiment of the present invention;

Fig. 5 is a perspective view of the cover and the tank according to the second embodiment of the present invention;

Fig. 6 is a cross-sectional view of the cover and the tank according to a modification of the second embodiment of the present invention;

Fig. 7 is a schematic cross-sectional view of a front portion of a vehicle for explaining entering of an antifreezing agent of a related art; and

Fig. 8 is a schematic cross-sectional view of a front portion of a vehicle and a cover fixed to a tank of a heat exchanger of a related art.

DETAILED DESCRIPTION OF EMBODIMENTS

Embodiments of the present invention will be described hereinafter with reference to drawings.

In the first embodiment, a cover structure that restricts foreign materials is employed for a radiator, which is generally mounted in a front portion of a vehicle. As shown in Figs. 1 and 2, a cover (cover member) 100 is used as the cover structure for a radiator 200.

The radiator 200 cools a coolant of an engine (not shown). A core portion 220 of the radiator 200 is constructed of a stack of tubes and fins. The core portion 220 performs heat exchange between air and the coolant. A core plate 221 is interposed between the core portion 220 and a resinous tank 210. The tank 210 is clamped with the core plate 221. The tank 210 is formed of nylon 66 (polyamide 66) that includes a predetermined amount of glass fiber as a reinforcing agent.

As shown in Fig.1, the radiator 200 is mounted on a rear side of a grill 10, which forms an opening through which a cooling air is introduced, in an engine compartment 5. The radiator 200 is fixed to a vehicular frame (fixing member) 20

having substantially a U-shaped cross-section. A condenser 300, which is a heat exchanger for a cooling apparatus, is provided between the grill 10 and the radiator 200.

The cover 100 is made of resin such as polypropylene. As shown in Fig. 2, the cover 100 is formed with a cover portion (wall) 110 in a form of plate and two fixing portions 120. The fixing portions 120 substantially perpendicularly protrude from the cover portion 110. Fixing holes 121 are formed in substantially middle position of the fixing portions 120. Clips 130 are inserted to the fixing holes 121 and further engaged with holes 21 formed on the frame 20, so the cover 100 is fixed to the frame 20.

The clip 130 has stoppers in the form of parasol at its top end. Also, the clip 130 is formed with slit in its central portion along its longitudinal direction. Therefore, the clip 130 is elastically deformable during the insertion and is snapped into the holes 121, 21 with a single motion.

The cover 110 has generally a plate shape extending in a longitudinal direction of the tank 210. The cover 100 is arranged such that the cover portion 110 extends between the grill 10 and the core plate 221. Specifically, a first side 111 is arranged adjacent to the core plate 221, which defines a boundary between the tank 210 and the core portion 220. A second side 112, which is opposite to the first side 111, is arranged adjacent to the top end of the grill 10. The cover 100 is arranged such that distances between the core plate 221 and the first side 111 and between the core plate 221 and the

second side 112 are minimized.

While the vehicle is driven on roads on which an antifreezing agent is spread for example in cold regions, if the antifreezing agent is thrown up, the antifreezing agent is likely to enter the engine compartment 5 from the grill 10, as denoted by a thick arrow A in Fig. 1. In this case, because the cover portion 110 blocks the antifreezing agent, it is less likely that the antifreezing agent directly adhere to the resinous tank 210. Therefore, the cover structure reduces environmental stress cracks on the resinous tank 210 due to foreign materials such as the antifreezing agent. Accordingly, it is not required to blend resistance materials with the resin of the tank 210.

Since the cover 100 is made of polypropylene, water absorption of the cover 100 is lower than that of the tank 210 made of nylon. Therefore, the cover 100 is less likely to cause the environmental stress cracks even if the antifreezing agent adheres to the cover 100.

In addition, since the cover portion 110 is arranged to extend from the proximity of the core plate 221 to the grill 10, it functions as a duct for directing the cooling air toward the core portion 220. Thus, the cover portion 110 restricts the cooling air from passing over the tank 210 (as denoted by a dotted arrow in Fig. 8). Also, the cover portion 110 is disposed such that it does not obstruct the core portion 220. Accordingly, the cooling air passing through the grill 10 is effectively applied to the core portion 220,

thereby improving efficiency of heat exchange of the radiator 200. With this, it is possible to reduce the size and further cost of the radiator 200. By the cost reduction of the radiator 200, expense of the cover 100 can be offset.

The radiator 200 generally has a second tank (not shown) through which coolant flows at its bottom. When the radiator 200 is arranged such that the tank (first tank) 210 is on the top of the core portion 220 and the second tank is on the bottom, a temperature of the coolant flowing in the first tank 210 is higher than that of the coolant flowing in the second tank. Therefore, the first tank 210 is in an environment that easily causes environmental stress cracks, as compared to the second tank. In a case that the cover structure is applied to the top tank 210 of the radiator, it effectively reduces damage to the tank 210.

As a modification of the first embodiment, protrusions 122, which correspond to the clips 130, are formed in the fixing portions 120. As shown in Fig. 3, the protrusions 122 have shapes similar to the clips 130 so that the protrusions 122 are engaged to the holes 21 or hollows of the frame 20. Since it is not required to form the clips 130 separately, a manufacturing cost reduces.

In the second embodiment, the cover 100 is directly connected to the tank 210. As shown in Figs. 4 and 5, the tank 210 has protrusions 211, which correspond to the clips 130 of the first embodiment. The cover 100 is fixed by engaging the protrusions 211 in the holes 121 of the fixing portions 120.

Accordingly, it is possible to mount the radiator 200 on the vehicle after the cover 100 is fixed to the tank 210. Also, it is possible to fix the cover 100 to the radiator 200 after the radiator 200 is mounted on the vehicle. Thus, assemblability of the cover structure improves. Further, this is suitable in a case that the frame 20 has less space for fixing the cover 100.

As a modification of the second embodiment, protrusions 122 corresponding to the clips 130 of the first embodiment are integrally formed in the cover 100. As shown in Fig. 6, fixing holes 212 engaging with the protrusions 122 are formed in a wall that is provided as a part of the tank 210. The cover 100 is fixed to the tank 210 by engaging the protrusions 122 with the fixing holes 212.

In the first embodiment and the second embodiment, the cover structure is used for the radiator 200, which cools the engine coolant. However, the cover structure of the present invention can be used for another heat exchanger having a resinous tank, which is located on the rear side of the grill 10, such as an inter cooling device.

It is not always necessary that the hole, which engages with the protrusion for fixing the cover 100, is a penetrated hole. It can be a hollow or depression as long as provides an engagement with the protrusion.

The present invention should not be limited to the disclosed embodiments, but may be implemented in other ways without departing from the spirit of the invention.